

HJ

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Technical Specifications for Determination of emitting Radionuclides in Soil by In-situ HPGe Spectrometry

就地高纯锗谱仪测量土壤中 γ 核素技术规范

(English Translation)

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Foreword

To implement the Environmental Protection Law of the People's Republic of China, the Law of the People's Republic of the Nuclear Safety Law of the People's Republic of China, which protects the ecological environment and public health, regulates the measurement of nuclides in the soil with high purity germanium spectrometers this standard is specially formulated for the methods of activity concentration and ash deposition flux of radioactive sedimentation.

Appendix A to Appendix G of this standard are informative appendices.

This standard is issued for the first time.

This standard is formulated by the Department of Nuclear Facilities Safety Supervision and the Department of Regulations and Standards of the Ministry of Ecology and Environment.

Drafting organizations of this standard. Nuclear and Radiation Safety Center of Ministry of Ecology and Environment, Radiation Environment Monitoring Technology Center of Ministry of Ecology and Environment, North China Electric Power University, Anhui Radiation Environment Supervision Station.

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This standard is interpreted by the Ministry of Ecology and Environment.

Technical specification for measuring nuclides in soil with in-situ high purity germanium spectrometer

1 Scope of application

This standard specifies the in-situ measurement of radioactive activity concentration of nuclide and the flux of radioactive deposition ash in soil.

High purity germanium spectrometer measurement method.

This standard is applicable to the determination of artificial radioactivity in surface soil nuclides during emergency monitoring of nuclear accidents, and radiation environmental quality monitoring can refer to implementation.

For newly settled radioactive ash, the detection limit of ^{137}Cs activity concentration determined by this standard is 100 Bq/m².

2 Normative references

This standard quotes the following documents or their clauses. For undated reference documents, their valid versions are applicable to this standard.

GB/T 27418 Evaluation and Expression of Uncertainty in Measurement ISO 18589-7 Measurement of Environmental Radioactivity-Soil-Part 7. Measurement of Nuclides (Measurement of radioactivity in the environment-Soil-Part 7: In situ measurement of gamma-emitting radionuclides)

3 Terms and definitions

The following terms and definitions apply to this standard.

3.2 Energy resolution energy resolution

The detector's ability to distinguish incident gamma rays with different but very similar energies. Energy resolution and incident gamma ray energy Regarding, for a single energy ray with a specified energy, it is often expressed by the half-width of the full-energy absorption peak of the energy, keV.

3.3 Full width at half maximum

In the pulse height spectrum, the distance between the abscissas of two points at half the peak of a single peak, keV. The half-height width is also recorded as FWHM.

Note: If the peak in the energy spectrum is composed of several peaks superimposed, each peak has a half-width.

3.4 Field-of-view of a detector

Characterizes the amount of the detector's measurement of the surface soil range, that is, 90% of the non-scattered rays measured by the detector come from this range the soil inside. Generally expressed by the radius of the measuring soil range, m.

3.5 Lower limit of detection (LLD)

With a given degree of confidence, the in-situ high-purity germanium spectrometer can detect the lowest activity concentration or the smallest deposition flux.

3.6 in-situ measurement Do not make any physical or chemical property treatment or change of the object to be measured, and the measurement is carried out at the site where it is located.

3.7 Detection height

The vertical height of the geometric center of the high purity germanium crystal from the ground surface, m.

3.11 Effective front area

A parameter that characterizes the detection efficiency of the detector's all-energy absorption peak, that is, the ray beam with energy E is incident parallel to the axis of the detector in the case of the unit fluence rate, the all-around absorption peak count rate, m².

3.12 Angle correction factor

For the ray with energy E , the in-situ high-purity germanium spectrometer is parallel to the measurement along the axis of the detector during actual measurement on the ground surface in the field.

When the line is incident, the unit the ratio of the total energy absorption peak count rate obtained from the ray fluence rate, the quantity of dimension one.

4 Principle of the method

The fluence rate of surface gamma rays is related to the activity concentration of the radionuclide in the soil (deposition flux), and the depth of the nuclide in the soil.

Degree distribution is related to factors such as soil composition and moisture content. When the detector height is 1 m, the on-site high-purity germanium spectrometer measures the count rate of the all-energy absorption peak is proportional to the activity concentration of the radionuclide in the soil.

5 Apparatus and equipment

5.1

High purity germanium spectrometer. consists of high purity germanium detector, high voltage power supply, main amplifier, multi-channel pulse amplitude analyzer, refrigeration unit it is composed of 6 main parts, including liquid nitrogen or electric refrigeration, and data processing system.

5.2

Bracket. A bracket capable of fixing the detector so that the height of the detector is 1 m above the ground should use a low atomic number, low Density material manufacturing (such as. aluminum, plastic, wood).

5.3

Tape measure. the calibration length of the tape measure should be greater than 1 m, and the calibration graduation should not be less than 1 mm.

5.4

Other auxiliary equipment. should be equipped with a geographic positioning system to record geographic coordinates during testing.

6.1 Distribution principle

In general, choose an open and flat area, and there should be no interfering objects (such as building Buildings, woods, etc.), see Appendix A for the field of view R_s of the detector.